IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Barrera et al.	GROUP ART UNIT: 3752
Serial No.: 09/675,860	EXAMINER: Christopher S. Kim
Filed: September, 29, 2000	DATE: February 26, 2008
For: APPARATUS AND METHOD OF EFFECTIVE FLUID INJECTION AND VAPORIZATION FOR CHEMICAL VAPOR DEPOSITION APPLICATION	

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Commissioner for Patents
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APPELLANTS' REPLY BRIEF

In the Examiner's answer mailed December 26, 2007, the Examiner raised certain points of argument to which appellants respectfully submit this reply. This reply brief is being filed pursuant to 37 C.F.R. § 41.41.

1. Ground for Rejection to Claim 31 under 35 U.S.C. § 112, first paragraph, withdrawn by Examiner

The Examiner has withdrawn the rejection of claim 31 under 35 U.S.C. § 112, first paragraph. The Examiner has maintained the rejection of claim 31 under 35 U.S.C. § 112, second paragraph, which appellants address in further detail herein.

2. Response to Examiner's Arguments

35 U.S.C. § 112 Issues

The Examiner has rejected claim 31 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicants/appellants regard as the invention. Appellants respectfully disagree.

The Examiner states that the phrase "... while not requiring the use of capillary tubes to create a pressure differential ...," is uncertain.

Appellants disagree, noting that this negative limitation was discussed in detail within the specification. The detriments of using capillary tubes to create the pressure drop were identified in the following manner:

> Presently, the methods used to introduce these low flow rates of dopants and TEOS into the chamber require pre-mixing of the liquids. Once these liquids are pre-mixed, they are passed through a high pressure drop capillary tube which drops the pressure of the liquids to the low pressure levels required for vaporization and introduction within the process chamber. This high pressure drop capillary tube also prevents cavitation from occurring in the liquid supply lines. *One difficulty with using capillary tubes, however, is the inherent limitations on pressure drops. The pressure drop in a capillary tube is inversely proportional to its length, and proportional to the fourth power of the diameter of the tube (D4/L). As a result, depending upon the flow rate required, either the pressure drop across the capillary tube will be excessive or the capillary tube will need to be extremely long to meet the flow rate required for the specific process.* Moreover, capillary injector tubes are generally sophisticated in their configuration, and difficult to manufacture and service.
> Specification, p.3, ll.2-15 (emphasis added).

The present invention uses a design that does not require using the capillary tubes to create a pressure differential, which is normally how capillary tubes have been used in the prior art.

> In the instant invention, capillary tubing is needed to supply liquid to the throat of the injector 28; however, because of the constant pressure design of the nozzle, the capillary tubing does not need to be as restrictive in its inner diameter dimensions as those of the prior art.
> Specification, p.7, ll.26-29.

As stated in the specification, the capillary tubes are not used to create the pressure differential. This is a significant difference from the prior art. Appellants concur that this is a negative limitation, but it is a limitation nonetheless, and contributes to making the apparatus of the present invention patentably distinct.

Regarding the Examiner's concern of uncertainty, appellants rely on the wording of the claim: "... introducing TEOS and other dopant fluids at a high pressure, while not requiring the use of capillary tubes to create a pressure differential ... ." Claim 31. This statement (negative limitation) is supported by the specification:

> The cross-flow injector operating under the conditions set forth in Table 1 above for helium would allow the introduction of TEOS and other dopant fluids at a relatively high pressure (29.2 psia), *and would not require the use of capillary tubes to create a pressure differential. The choked, narrowed throat provides this needed pressure differential.* Helium is used mainly to offset the auto-ignition concerns with TEOS. Other gases, including oxygen, could be used when explosive concerns are not present. Equation (6) is satisfied for the use of Helium since the Webber number, 1.963 E-7, is much less than the ratio of pressures, P2/P1, equal to 4.026 E-4. Thus, the TEOS will be fully atomized using the cross-flow injector.
> Specification, p.13, l.27 – p.14, l.7.

It is clear from the specification that the claimed apparatus is not relying on capillary tubes to create the desired pressure differential. Appellants respectfully submit that the limitation as claimed is supported by the specification, and does not lead to uncertainty. Clearly, if capillary tubes are used to create the desired pressure differential for the introduction of TEOS, this would be outside the scope of the present invention.

The Examiner further states that phrase "pressure differential" appears to be a double inclusion. Appellants respectfully disagree. The capillary tubes simply introduce the dopants, and specifically the TEOS to the chamber. "Importantly, in the present invention the capillary tubing is used only to supply liquids for the instant invention." Specification, p.12, ll.22-23. As cited above, the capillary tubes do not provide for a pressure differential as is normally expected of such tubes in the prior art. In other words, the cross-flow injector, not a high pressure differential at the capillary tubes, performs the necessary atomization. In the present invention, "[t]he choked, narrow throat provides this needed pressure differential." Specification, p.14, ll.2-3.

Appellants submit that claim 31 is neither uncertain nor ambiguous, and is amply supported by the specification.

35 U.S.C. § 103 Issues

The Examiner has rejected claims 1-5, 7-10, 12-17, 19-21 and 26-31 under 35 U.S.C. § 103(a) as being unpatentable over Gwyn (U.S. Patent No. 4,397,422) in view of Holt (U.S. Patent No. 5,501,397). Appellants respectfully disagree with this rejection.

The Examiner states that "[n]either the specification nor the claims limit the term 'chemical vapor deposition chamber' to any particular definition." Examiner's Answer, p.5.

Appellants continue to maintain that the specification is replete with references to a chemical vapor deposition for use in the semiconductor arts. For example, in at least one embodiment, the appellants have endeavored to inject a carrier fluid (gas) such as tetraethylorthosilicate (TEOS) along with precursors and dopants into the gas manifolding leading to a reactor chamber for semiconductor processing. Specification,

p.2, ll.16-19; Application Example, p.13. The introduction of TEOS is a well known process for use in the chemical vapor deposition of semiconductor devices. Even if, *arguendo*, TEOS is not positively cited as the Examiner maintains, its presence requires specific structural considerations on the chamber that could not possibly be satisfied by the combination of Gwyn or Holt. Persons of ordinary skill in the art understand that the introduction of TEOS must be performed in a chamber that can hold a vacuum, which is precisely the type of chamber required for chemical vapor deposition for semiconductor processing, not automobile painting. Furthermore, the specification identifies a carrier fluid, such as O_2, N_2, or He, which is also well known in semiconductor processing. Specification, p.8, ll.17-18. Gwyn and Holt do not teach or specify any such carrier fluid, since there is no need to do so when applying spray paint to automobiles.

In claims 1, 13, 28 and 31, the chemical vapor deposition chamber is positively cited. The references within the specification to semiconductor processing, and the use of semiconductor processing gases, such as TEOS, as well as carrier gases common to semiconductor processing, provide ample support as to exactly what kind of chamber the claimed subject matter is referring when the chemical vapor deposition chamber is cited.

The Examiner further states that "semiconductor" is not a positively recited claim limitation. Examiner's Answer, p.7. Appellants respectfully disagree. Claim 1 states in pertinent part, "chemical vapor deposition chamber for processing a semiconductor substrate." Appellants believe this to be a sufficient claim limitation on the type of chemical vapor deposition chamber claimed. It would appear that had appellants called this chamber a "semiconductor substrate processing chemical vapor deposition chamber," this claim limitation would have been considered positively cited, but such semantics

would not have changed the meaning of the structural limitation of the apparatus as currently phrased.

Claims 3 and 15 require the throat region to be configured to operate at a critical mach number of 1. Gwyn does not teach or disclose any such configuration conditions. As stated in Appellants' brief, there is a critical analytical formulation to achieve a mach number of 1 for this design. Gwyn (and Holt) remains completely silent with respect to any such condition, chiefly because the prior art references do not teach chemical vapor deposition for semiconductor processing. Consequently, the concept of a mach 1 application is not approached by the prior art. The Examiner states, "Gwyn's device has the ability to operate at Mach 1 if fluid is pushed through Gwyn's device at Mach 1." Examiner's Answer, p.10. This argument highlights the lack of any suggestion or teaching in Gwyn for a Mach 1 delivery of spray paint. A complex analytical formulation must be satisfied to achieve mach 1 speed and delivery, which the prior art of automobile spray painting need not concern itself, and indeed remains completely silent in this regard.

The Examiner also states that the claims do not require the first, second, and third temperatures to be different, and thus, the absence of any reference to temperatures in the Gwyn or Holt prior art designs is not material. Appellants note that the specification has explicitly identified an analytical relationship between the temperatures:

> Similarly, a ratio of the temperature at the throat to the temperature at the inlet may be expressed as the following:
>
> $T_2/T_1 = 2/(k+1)$ (4)
>
> where,
>
> T_1 is the stagnant temperature; and,
>
> T_2 is the throat temperature.
>
> Specification, p.12, ll.1-6; see also, Table 1, p.13.

Consequently, the present invention teaches that the temperatures, T_1 and T_2, are different (remembering that k is the ratio of specific heats).

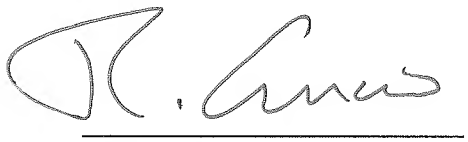
Regarding claims 13 and 30, the Examiner relies on a different interpretation for the exit nozzle than previously relied upon for other claims. With regard to claims 13 and 30 the Examiner states, "in claim 13, the exit nozzle is considered to be the portion of the throat region 19 downstream of aperture 20." Examiner's Answer, p.5. Whereas, in the rejection of claim 1, the Examiner considered the exit nozzle to be the expanding portion 15 of Gwyn, stating, "[t]he pressure in the exit nozzle 15 is lower than that of the throat region 19 because of the expansion of the flow that results from the diffuser effect of exit nozzle 15." Id. These represent different structural portions of the Gwyn apparatus. Appellants respectfully submit that these apparently inconsistent interpretations are hindsight reconstructions that attempt to fit two distinctly different structural embodiments of present invention with the same prior art references.

3. Conclusion

It is submitted that Appellants' main brief addressed all of the relevant issues raised by the Examiner in his final rejection, and the arguments put forth by the Examiner in his answer do not support a rejection of the Appellants' claims, for the reasons previously set forth in the Appellants' main brief and those delineated herein.

For the foregoing reasons stated in the Brief for Appellants and those herein, it is respectfully requested that this Board overrule the Examiner's rejections.

Respectfully Submitted,



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